On the Semi-diameter of Venus. By W. G. Thackeray.

(*Communicated by Mr. Downing.*)

In the *Monthly Notices*, vol. xxv. p. 57, Mr. Stone has discussed the observations of *Venus* with the Greenwich Mural and Transit Circles for the years 1839–62. Assuming that the error arising from personality is sensibly eliminated when the number of observers is considerable, and that it is practicable when the number of observations are sufficiently numerous to separate the constant part of the diameter due to the instrument from the part which varies with every change in the planet's distance, he obtained a correction to be applied to the *N.A.* semi-diameter when a single limb only was observed—

viz. $+0''.392 \quad + (0.0269 \times$ *N.A.* semi-diameter.)

a correction which has been applied to the Greenwich observations when needed up to the present time. In 1865 Encke's value ($8''.305$) of the semi-diameter at the mean distance of the Sun from the Earth was used in the *Nautical Almanac*, instead of the value previously used, $8''.250$. Let $8''.305\ (1+y)$ be the true semi-diameter, and let x be the constant quantity by which the computed diameter would require to be corrected to agree with the observed diameter. Then, $x + (1+y)$ *N.A.* diameter = observed diameter. Taking the values of the *N.A.* and observed vertical diameters, as given in the planetary results of the Greenwich observations for the years 1866–84, and separating the observations into two classes, those above $20''$ and those below $20''$ in diameter, by simple summation, we get two equations for the determination of the values of x and y:—

$$302x + 10192.2y = 431.66$$
$$590x + 7629.4y = 757.75$$

from which we obtain

$$x = +\ 1''.196\ \pm$$
$$y = +\ 0.0067\ \pm$$

This gives the value of the semi-diameter at the mean distance of the Sun from the Earth $= 8''.360$, and the correction to be applied in the case of a single limb being observed becomes

$+\ 0''.598 + (0.0067 \times$ *N.A.* semi-diameter).

Now let us assume that the error of personality is not sufficiently eliminated by the number of the observers, and only use

the observations made by the four regular observers at the present time, we then get

		Above 20″.	Below 20″.
A. D.	(1873–84)	$25x + 742{\cdot}5y = 46{\cdot}27$	$70x + 891{\cdot}1y = 112{\cdot}79$
T.	(1875–84)	$19x + 611{\cdot}8y = 29{\cdot}07$	$59x + 758{\cdot}6y = 43{\cdot}91$
L.	(1881–84)	$18x + 570{\cdot}3y = 13{\cdot}23$	$11x + 130{\cdot}8y = 2{\cdot}71$
H.	(1882–84)	$5x + 177{\cdot}4y = 14{\cdot}21$	$20x + 254{\cdot}3y = 13{\cdot}87$
		$67x + 2102{\cdot}0y = 102{\cdot}78$	$160x + 2034{\cdot}8y = 173{\cdot}28$

from which we obtain

$$x = +\,0''{\cdot}776 \pm$$
$$y = +\,0{\cdot}0241 \pm$$

This gives semi-diameter at the mean distance of the Sun from the Earth $8''{\cdot}505$, and the correction to be applied to a single limb becomes $+0''{\cdot}388+$ ($0{\cdot}0241 + N.A.$ semi-diameter), a correction which happens to agree very closely with the one at present applied. Now, considering that the first set of equations refer to a considerable number of observations and observers, it would seem that the value of x is not independent of the error of personality, and that the value of y does vary with the change in the planet's distance; and if we solve the different equations referring to the different observers, we get

		Mean Semi-diameter.
For A. D.	$x = +\,1''{\cdot}432 \pm$ $y = +\,0{\cdot}0141 \pm$	$8''{\cdot}422$
T.	$x = +\,0{\cdot}180 \pm$ $y = +\,0{\cdot}0426 \pm$	$8{\cdot}659$
L.	$x = -\,0{\cdot}049 \pm$ $y = +\,0{\cdot}0248 \pm$	$8{\cdot}511$
H.	$x = -\,0{\cdot}506 \pm$ $y = +\,0{\cdot}0943 \pm$	$9{\cdot}088$

From these values it would appear that the amount of personality involved in the observation is much greater than the correction due to the instrument; and that, though a greater number of observers may be likely to give a more accurate value and compensate one another, it is just as likely that they should not.

On the Orbit of α Centauri. By E. B. Powell.

In two papers, published respectively in the *Monthly Notices* for November 1884 and March of the current year, I have assigned grounds for the conclusion that a period of some 76 years will not satisfy the imperfect observations of *α Centauri* taken in past centuries, and those made with fixed instruments in the early portion of the present one, and that a time of revolu-

tion of 86 years or upwards is required for this purpose. I now do myself the pleasure of laying before the Society a set of elements for that binary, with a period somewhat exceeding 87 years, which appear to satisfy fairly the recorded equatorial measures.

The calculations made by me upon the subject have been rather numerous. After arriving at an orbit which afforded a moderately fair representation of the motion from 1834 to 1884, eighteen epochs were selected as giving measures of apparently very considerable accuracy, and at the same time pertaining to telling points in the perspective ellipse. Variations of position-angle were then found for variations in the elements corresponding to the selected epochs; and, finally, equations of condition were formed and solved by the method of least squares. By taking at first some of the elements, P, τ and e for example, finding and applying the corrections thus afforded, and then determining the corrections of the remaining elements from the residual errors, orbits differing slightly were arrived at. The corrections of all the elements were also found simultaneously. In no case did P come out less than 86 years, and in only one was a considerably greater value obtained; this last value, which was afforded by the simultaneous solution of the equations for all the elements, I considered inadmissible for reasons connected with the early notices of the star, though the set of elements to which it belonged somewhat reduced the magnitude of the differences between observation and calculation for the eighteen epochs. Ultimately the elements given below were adopted. Of these, P and τ were obtained from ten equations of mean motion formed by combining different pairs of measures corresponding to considerable intervals of time, no interval being less than 25·8 years. The different values of P and τ thus found agreed well with one another, only one value of P falling so low as 86 years, two slightly exceeding 88, and the rest lying between 87 and 88 years. The remaining elements were determined by applying the method of least squares to the variation equations, using the residual errors of position after correcting for P and τ. Finally, the semi-major axis was found from eighteen measured distances. The extreme values were $19''\!\cdot\!287$ and $18''\!\cdot\!259$; the mean of the whole is the value adopted.

Elements.

$P = 87\cdot438$ years.

$\tau = 1875\cdot447$.

$e = \cdot544326$.

$\gamma = 79^\circ\ 47'\ 8''$.

$\Omega = 25^\circ\ 49'\ 38''$.

$\lambda = 48^\circ\ 59' - 17''$, $\varpi = 37^\circ\ 21'\ 9''$.

$a = 18''\!\cdot\!89$.

It may be noticed that, along with an increase of P, besides obtaining a larger value of a, we get an earlier time of periastron passage and an augmentation of the eccentricity.

Comparison of Observation with the results afforded by the above Elements.

Observer.	Epoch. 1800+	θ_o °	d_o ″	$\theta_o - \theta_c$ °	$d_o - d_c$ ″
Herschel	34·790	218·55	17·4	− ·72	−·41
Herschel	37·345	220·73	16·20	− ·48	·00
Jacob	47·090	235·10	9·45	− ·39	+·38
Jacob	48·010	238·00	8·03	− ·15	−·33
Maclear	50·313	247·07	6·75	− ·19	+·12
Maclear	51·565	254·42	5·88	− ·02	+·12
Maclear	52·793	263·31	4·99	− ·48	·00
Maclear	53·503	271·03	4·68	+ ·52	+·05
Jacob	54·391	281·38	4·30	+1·03	+·03
Powell	54·631	283·47	—	+ ·19	—
Powell	55·047	289·05	4·12	+ ·46	+·03
Maclear	55·357	291·96	4·38	− ·75	+·35
Maclear	56·022	302·13	3·95	+ ·31	−·03
Jacob	56·209	304·24	4·02	− ·77	+·04
Jacob	56·922	315·30	3·96	+1·20	−·10
Maclear	57·390	320·60	4·47	+ ·44	+·30
Jacob	57·991	327·49	4·24	+ ·08	−·12
Jacob	58·272	330·60	4·38	+ ·05	−·10
Maclear	59·228	339·42	5·09	− ·62	+·15
Maclear	60·183	349·34	—	+1·60	—
Maclear	60·346	348·87	5·59	− ·03	−·01
Powell	60·479	348·70	5·60	−1·11	−·08
Maclear	61·090	353·65	6·09	− ·03	+·01
Powell	62·205	358·00	6·79	−1·56	−·04
Maclear	62·560	1·38	7·55	+ ·21	+·48
Powell	63·028	1·40	7·20	−1·73	−·19
Ellery	63·750	5·20	8·50	− ·64	+·63
Powell	64·110	5·7	7·85	−1·37	−·26
Powell	66·063	11·10	9·30	−1·61	+·01
Powell	70·100	20·45	10·24	− ·95	−·27
Russell	70·746	22·32	10·46	− ·37	+·03
Powell	71·310	23·70	9·80	− ·14	−·46
Russell	72·468	25·33	9·73	−1·05	+·11
Russell	73·331	28·07	9·50	− ·52	+·66

Observer.	Epoch. 1800+	θ_0 °	d_0 ″	$\theta_0-\theta_c$ °	d_0-d_c ″
Ellery	74·150	30·50	8·00	− ·66	+ ·16
Lindsay	74·850	34·17	—	+ ·14	—
Seelinger	75·020	34·21	6·82	− ·66	+ ·31
Russell	76·411	46·97	4·35	+ ·43	+ ·39
Ellery	76·615	51·05	4·15	+ 1·35	+ ·58
Maxwell Hall	77·140	64·40	3·30	+ 2·34	+ ·69
Russell and Gill*	77·602	81·46	1·97	− ·95	+ ·03
Gill	77·848	97·57	1·79	− 1·18	+ ·07
Maxwell Hall	78·380	139·10	2·4	+ ·65	+ ·56
Ellery	79·252	174·40	3·41	+ 1·70	+ ·21
Tebbutt	80·186	186·70	4·97	+ 1·23	− ·05
Tebbutt	81·655	193·15	7·95	− ·40	+ ·09
Gill and Elkin	83·500	198·00	10·70	− ·14	− ·37
Tebbutt	84·533	199·80	12·93	+ ·05	+ ·27
Tebbutt	85·580	201·02	14·20	− ·01	+ ·06

In testing the elements, all the available observations have not been used. It seemed to me that the number taken, spread as they are over the whole circuit, would suffice to give a correct idea of the degree of correspondence between the orbit and observation. A comparison has not been made in the case of the Sydney observations subsequent to 1877, since it appears, as Mr. Downing has observed, that some influence must have operated to throw out these measures from accord with those taken at other Observatories. It also seemed that no object would be attained by introducing the Melbourne observation for 1876·94 into the comparison, as the position-angle is practically the same as that given by the observation at the same place for 1876·615, while the motion of the comes during the interval must have been about 6°; for the earlier date also there are two sets of position-measures, while for the later there is only one. In two or three cases, where an observer did not take a measure of distance contemporaneously with his position-measure, but observed the distances for closely adjacent epochs, the distance for the epoch belonging to the angle has been found by proportion.

I may remark that the orbit now submitted agrees fairly with the notices of the binary in past centuries, with the exception of Maskelyne's observation of distance, and La Caille's measures of Diff. Declination and Diff. Right Ascension; it also accords with the Declination measures of the early part of this century, save in the case of Fallows. The disagreement in these instances, as was urged in my recent Papers on the period of *α Centauri*, cannot well be held of much weight.

* Russell ·596, 81°·7, 1″·9; Gill ·609, 81°·23, 2″·02.

In conclusion, while I consider that the evidence is tolerably strong against the period of this binary being only some 76 years, I by no means assert that the time of revolution is precisely 87·438 years. I hold that several years of observation will be required to fix quite accurately the values of P, τ, and e; but, from the annexed Table, I think it is evident that in six or eight years, if careful measures be taken, the point will be settled as to whether the period is about 76 years or exceeds 86 years.

Epoch.	Downing-Elkin Orbit. P.	d.	Orbit now submitted. P.	d.
	°	″	°	″
1886·275	202·61	14·89	201·74	15·04
1889·275	205·16	17·70	204·10	18·30
1892·275	207·11	19·52	205·82	20·68
1895·275	208·79	20·54	207·24	22·33
1898·275	210·37	20·91	208·49	23·39
1901·275	211·93	20·74	209·65	23·93

Hampstead: April 1886.

The Magnitude of η Argûs in March 1886.

By W. H. Finlay, M.A.

I have examined the magnitudes of the stars in the neighbourhood of *η Argûs*, and compared them amongst themselves on several occasions recently, with the following result:—

The letters used to denote the stars are those given by Sir John Herschel on pp. 44–46 of his "Results of Astronomical Observations at the Cape of Good Hope." My observations for the magnitude of *Eta* (A) are

$$\mathrm{A}\left\{\begin{array}{r} =\mathrm{F} \\ =\mathrm{F} \\ \text{slightly} < \mathrm{F} \end{array}\right. \quad \left\{\begin{array}{l} <\mathrm{O} \\ <\mathrm{O} \end{array}\right. \quad \left\{\begin{array}{l} >\kappa' \\ =\kappa' \end{array}\right. \quad \left\{\begin{array}{r} >\mathrm{C} \\ \tfrac{1}{2}\text{ mag.} > \mathrm{C} \end{array}\right. \quad \left\{\text{slightly} < \beta.\right.$$

I also note β *very* slightly $<\lambda$.

The magnitudes of these stars, as given by Herschel himself and by Gould in the Cordoba Catalogue, are

	Herschel.	Gould.
F	8	8
O	7	7½
κ'	8	8
C	8	—
β	8	7½
λ	7	7½

whence η is not very different from 7½ magnitude.